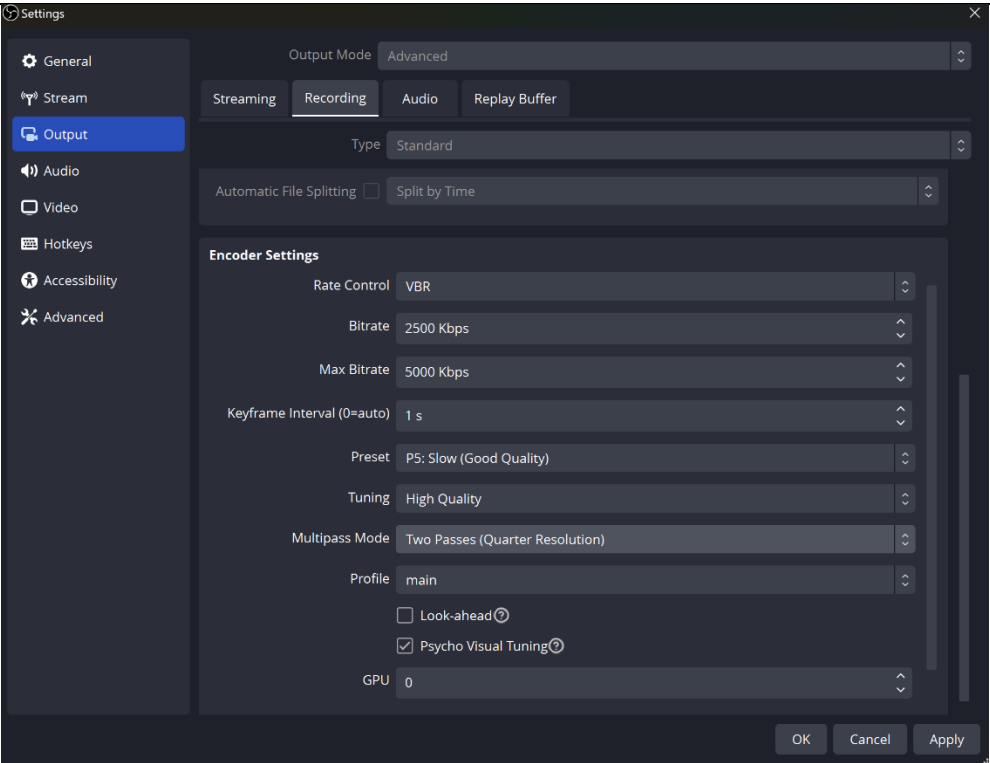


**Exhibit 8: U.S. Patent No. 9,179,147**

<b>Claims</b>	<b>Identification</b>
<p>10[pre] A video encoder for encoding a video by obtaining an optimal sequence of quantized coefficients for a block of transform residuals from the video, the video encoder comprising:</p>	<p>To the extent the preamble is limiting, Asus-branded devices implement a video encoder for encoding a video by obtaining an optimal sequence of quantized coefficients for a block of transform residuals from the video.</p> <div data-bbox="409 306 1558 670" data-label="Image"> <p>Get the ultimate creative experience with ASUS Vivobook Pro 16X OLED! It features the world's leading 16-inch 3.2K 120 Hz OLED Dolby Vision display<sup>1</sup>, the latest Intel® Core™ HX55 desktop-level processor and up to an NVIDIA® GeForce® RTX™ 4070 Laptop GPU — empowering maximum performance for any task, no matter how tough. This powerhouse is chilled by ASUS IceCool Pro thermal technology, with dual fans and four vents to keep it cool and quiet. It's also loaded with superb connectivity, including dual Thunderbolt™ 4 ports and a standard SD card reader for easy file transfers. With an onboard MUX switch and multi-dimensional Dolby Atmos audio built right in, Vivobook Pro 16X OLED also delivers maximum productivity and entertainment. Get ready to create!</p> </div> <p>Source: <a href="https://www.asus.com/us/laptops/for-creators/vivobook/vivobook-pro-16x-oled-k6604/">https://www.asus.com/us/laptops/for-creators/vivobook/vivobook-pro-16x-oled-k6604/</a></p>

Claims	Identification
	<div><p>The screenshot shows the OBS Studio Settings window, specifically the Output tab. The left sidebar contains a menu with options: General, Stream, Output (selected), Audio, Video, Hotkeys, Accessibility, and Advanced. The main area is titled 'Output Mode' and is set to 'Advanced'. Below this, there are tabs for 'Streaming', 'Recording' (selected), 'Audio', and 'Replay Buffer'. Under the 'Recording' tab, the 'Type' is set to 'Standard'. There is a checkbox for 'Automatic File Splitting' which is unchecked, and a dropdown for 'Split by Time'. The 'Encoder Settings' section includes: 'Rate Control' set to 'VBR', 'Bitrate' set to '2500 Kbps', 'Max Bitrate' set to '5000 Kbps', 'Keyframe Interval (0=auto)' set to '1 s', 'Preset' set to 'P5: Slow (Good Quality)', 'Tuning' set to 'High Quality', 'Multipass Mode' set to 'Two Passes (Quarter Resolution)', 'Profile' set to 'main', an unchecked checkbox for 'Look-ahead', a checked checkbox for 'Psycho Visual Tuning', and 'GPU' set to '0'. At the bottom right of the settings window are buttons for 'OK', 'Cancel', and 'Apply'.</p></div> <p>Source: Internal Testing of ASUS Vivobook Pro 16X OLED Laptop.</p>

Claims

Identification

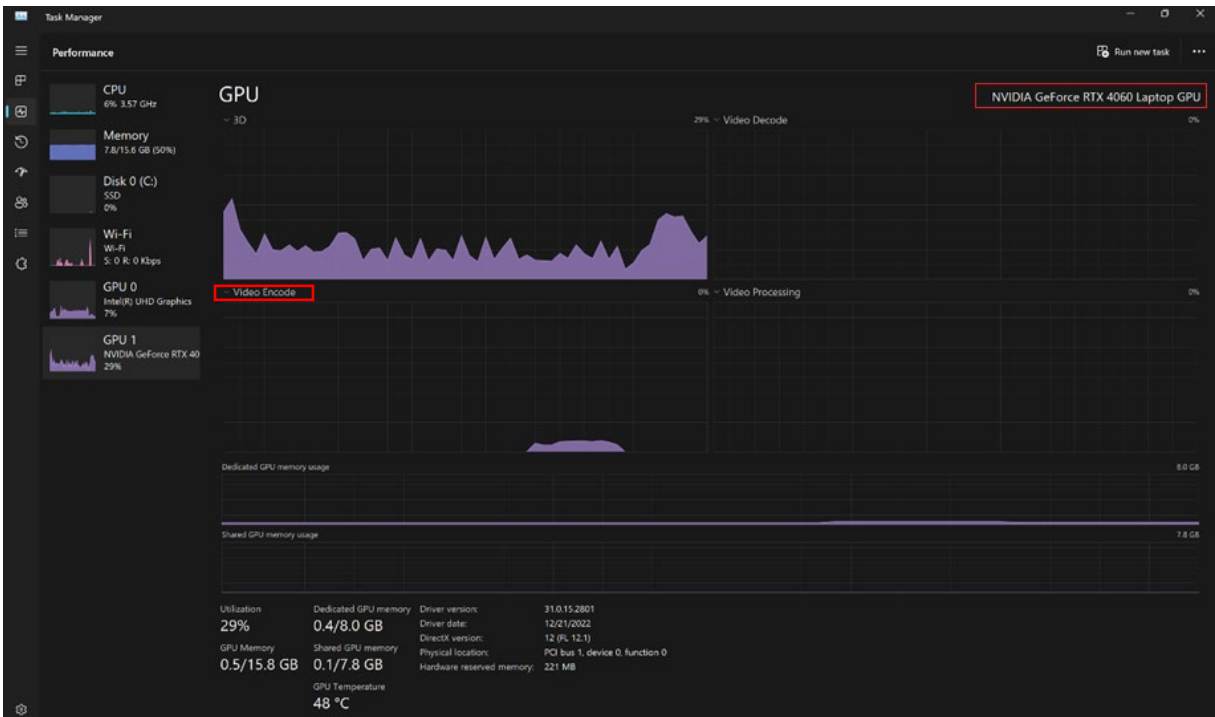
The screenshot displays the Windows Task Manager Performance tab. On the left, a sidebar lists system components: CPU (6% 3.57 GHz), Memory (7.8/15.6 GB (50%)), Disk 0 (C:) (SSD 0%), Wi-Fi (5.0 R, 0 Kbps), GPU 0 (Intel(R) UHD Graphics 7%), and GPU 1 (NVIDIA GeForce RTX 40 29%). The main area is titled 'GPU' and shows a graph of GPU usage over time, with a peak at 29% labeled 'Video Decode'. Below the graph, it shows 'Dedicated GPU memory usage' at 0.4/8.0 GB and 'Shared GPU memory usage' at 0.1/7.8 GB. At the bottom, a table provides detailed GPU information:

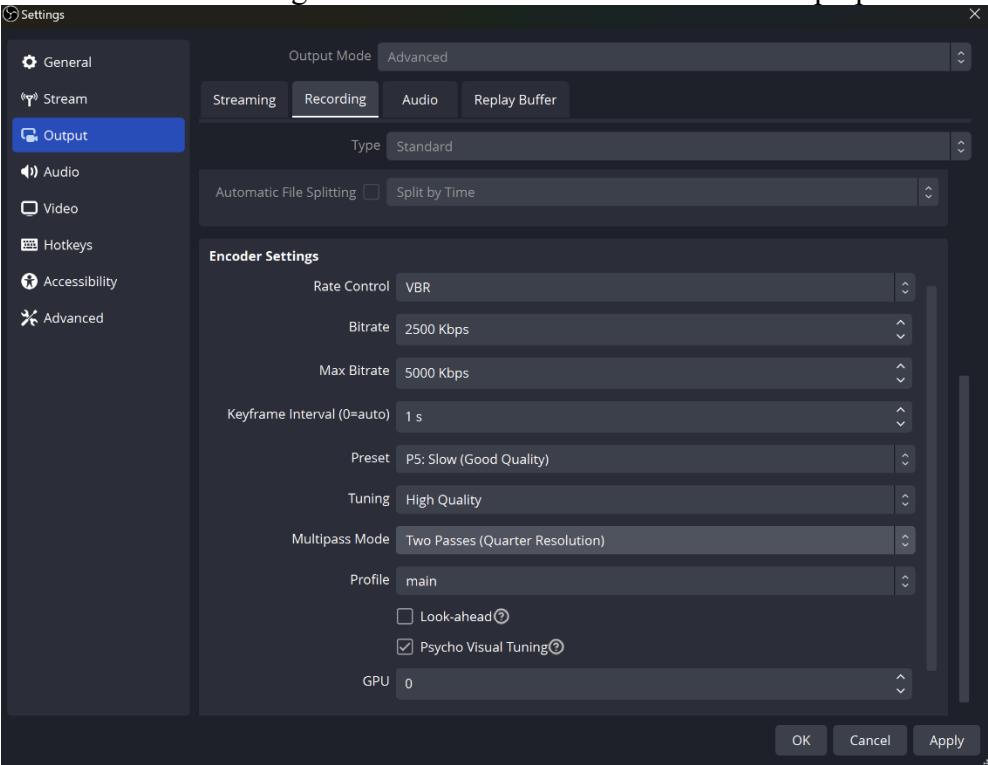
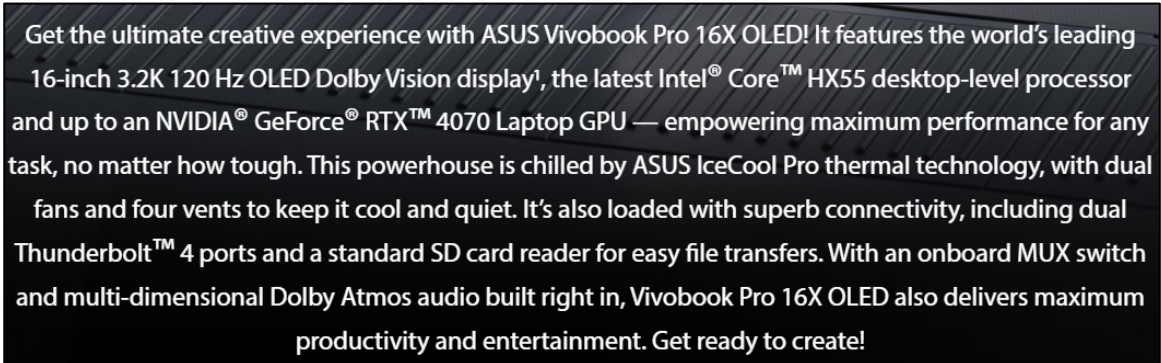
Utilization	Dedicated GPU memory	Driver version	31.0.15.2801
29%	0.4/8.0 GB	Driver date	12/21/2023
GPU Memory	Shared GPU memory	DirectX version	12 (FL 12.1)
0.5/15.8 GB	0.1/7.8 GB	Physical location	PCI bus 1, device 0, function 0
		Hardware reserved memory	221 MB
	GPU Temperature		48 °C


Source: Internal Testing of ASUS Vivobook Pro 16X OLED Laptop.

Claims	Identification
	<div><div><div>Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11</div><div>Document: JCTVC-Software Manual</div></div><div><div><div>Title: HM Software Manual</div><div>Status: Software AHG working document</div><div>Purpose: Information</div><div>Author(s): Frank Bossen David Flynn Karl Sharman Karsten Sühning</div><div>Source: AHG chairs</div></div><div><div>frank@bossentech.com dflynn@blackberry.com karl.sharman@eu.sony.com karsten.suehring@hhi.fraunhofer.de</div></div></div><div><div>Abstract</div><div><div>This document is a user manual describing usage of reference software for the HEVC project. It applies to version 16.8 of the software.</div></div><div><div>Contents</div><div><div><div>1 General Information2</div><div>2 Installation and compilation2</div><div>3 <u>Using the encoder</u>3</div><div><div>3.1 GOP structure table . . . . .3</div><div>3.2 Encoder parameters . . . . .7</div><div>3.3 Encoder SEI parameters . . . . .19</div><div>3.4 Hardcoded encoder parameters . . . . .27</div></div></div></div></div></div><div>Source: HEVC Encoder Manual (<a href="https://github.com/listenlink/HM/blob/master/doc/software-manual.pdf">https://github.com/listenlink/HM/blob/master/doc/software-manual.pdf</a>), 1</div></div>

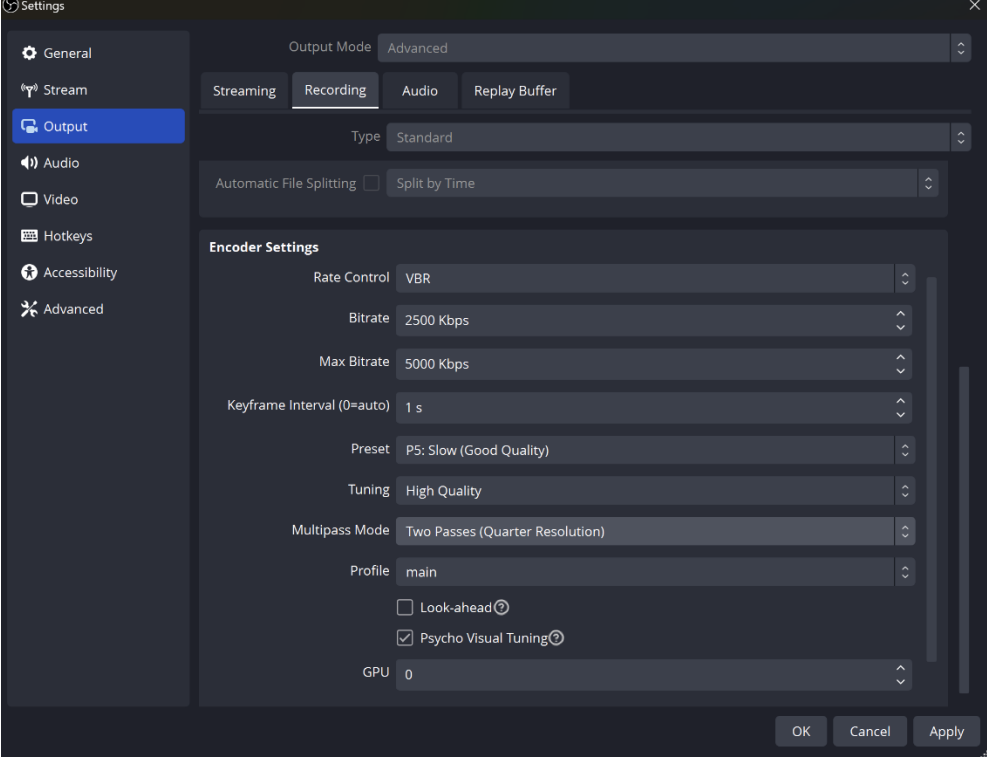
Claims	Identification																							
	<div><div>Table 9: Quantization parameters</div><table><tr><th>Option</th><th>Default</th><th>Description</th></tr><tr><td>QP (-q)</td><td>30.0</td><td>Specifies the base value of the quantization parameter. If it is non-integer, the QP is switched once during encoding.</td></tr><tr><td>CbQpOffset (-cbqpofs)</td><td>0</td><td rowspan="2">Global offset to apply to the luma QP to derive the QP of Cb and Cr respectively. These options correspond to the values of cb_qp_offset and cr_qp_offset, that are transmitted in the PPS. Valid values are in the range [-12, 12].</td></tr><tr><td>CrQpOffset (-crqpofs)</td><td>0</td></tr><tr><td>MaxCuDQPDepth (-dqd)</td><td>0</td><td>Defines maximum depth of a minimum CuDQP for sub-LCU-level delta QP. MaxCuDQPDepth shall be greater than or equal to SliceGranularity.</td></tr><tr><td><u>RDOQ</u></td><td><u>true</u></td><td>Enables or disables <u>rate-distortion-optimized quantization for transformed TUs.</u></td></tr><tr><td>RDOQTS</td><td>true</td><td>Enables or disables rate-distortion-optimized quantization for transform-skipped TUs.</td></tr><tr><td>SelectiveRDOQ</td><td>false</td><td>Enables or disables selective rate-distortion-optimized quantization. A simple quantization is use to pre-analyze, whether to bypass the RDOQ process or not. If all the coefficients are quantized to 0, the RDOQ process is by-passed. Otherwise, the RDOQ process is performed as usual.</td></tr></table></div>	Option	Default	Description	QP (-q)	30.0	Specifies the base value of the quantization parameter. If it is non-integer, the QP is switched once during encoding.	CbQpOffset (-cbqpofs)	0	Global offset to apply to the luma QP to derive the QP of Cb and Cr respectively. These options correspond to the values of cb_qp_offset and cr_qp_offset, that are transmitted in the PPS. Valid values are in the range [-12, 12].	CrQpOffset (-crqpofs)	0	MaxCuDQPDepth (-dqd)	0	Defines maximum depth of a minimum CuDQP for sub-LCU-level delta QP. MaxCuDQPDepth shall be greater than or equal to SliceGranularity.	<u>RDOQ</u>	<u>true</u>	Enables or disables <u>rate-distortion-optimized quantization for transformed TUs.</u>	RDOQTS	true	Enables or disables rate-distortion-optimized quantization for transform-skipped TUs.	SelectiveRDOQ	false	Enables or disables selective rate-distortion-optimized quantization. A simple quantization is use to pre-analyze, whether to bypass the RDOQ process or not. If all the coefficients are quantized to 0, the RDOQ process is by-passed. Otherwise, the RDOQ process is performed as usual.
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	<div>Source: HEVC Encoder Manual, 12</div> <div><div>A. Quantization of transform coefficients</div><div>In this stage the encoder performs calculation for each of transform coefficients separately. <u>In the first step, the encoder calculates the value Level by quantizing the magnitude of transform coefficient by using the uniform quantizer without dead zone.</u> In the next step, the encoder considers two additional magnitudes of the analyzed quantized coefficient: Level-1 and 0. For every of the mentioned coefficient magnitudes, the encoder calculates the RD cost of encoding the coefficient with the selected magnitude and chooses the one with the lowest RD cost.</div></div>																							

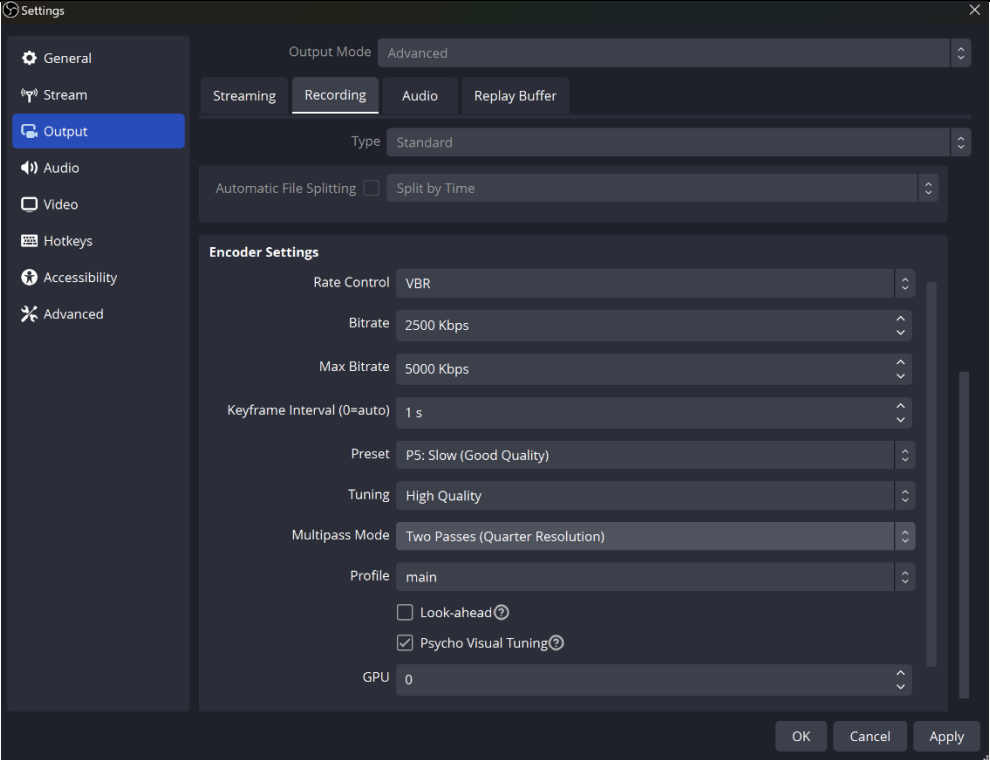
Claims	Identification																								
	Source: Rate-distortion optimized quantization in HEVC: Performance Limitations (https://www.researchgate.net/publication/279183792_Rate-distortion_optimized_quantization_in_HEVC_Performance_limitations), 3.																								
10[a] a processor;	<p>Asus-branded devices implement a video encoder comprising a processor.</p> <div><p>Get the ultimate creative experience with ASUS Vivobook Pro 16X OLED! It features the world's leading 16-inch 3.2K 120 Hz OLED Dolby Vision display<sup>1</sup>, the latest Intel® Core™ HX55 desktop-level processor and up to an NVIDIA® GeForce® RTX™ 4070 Laptop GPU — empowering maximum performance for any task, no matter how tough. This powerhouse is chilled by ASUS IceCool Pro thermal technology, with dual fans and four vents to keep it cool and quiet. It's also loaded with superb connectivity, including dual Thunderbolt™ 4 ports and a standard SD card reader for easy file transfers. With an onboard MUX switch and multi-dimensional Dolby Atmos audio built right in, Vivobook Pro 16X OLED also delivers maximum productivity and entertainment. Get ready to create!</p></div> <p>Source: <a href="https://www.asus.com/us/laptops/for-creators/vivobook/vivobook-pro-16x-oled-k6604/">https://www.asus.com/us/laptops/for-creators/vivobook/vivobook-pro-16x-oled-k6604/</a></p>  <p>The screenshot shows the Windows Task Manager Performance tab. On the left, a list of system components includes CPU (6% 3.57 GHz), Memory (7.8/15.6 GB (50%)), Disk 0 (C:) (SSD 0%), Wi-Fi (Wi-Fi 5: 0 R: 0 Kbps), GPU 0 (Intel(R) UHD Graphics 7%), and GPU 1 (NVIDIA GeForce RTX 40 29%). The main area displays performance graphs for GPU 1. A red box highlights the 'Video Encode' graph, which shows a peak in usage. Another red box highlights the 'NVIDIA GeForce RTX 4060 Laptop GPU' label. At the bottom, a summary table provides detailed GPU information.</p> <table><tr><th>Utilization</th><th>Dedicated GPU memory</th><th>Driver version</th><th>31.0.15.2801</th></tr><tr><td>29%</td><td>0.4/8.0 GB</td><td>Driver date:</td><td>12/21/2022</td></tr><tr><td>GPU Memory</td><td>Shared GPU memory</td><td>DirectX version:</td><td>12 (12_1)</td></tr><tr><td>0.5/15.8 GB</td><td>0.1/7.8 GB</td><td>Physical location:</td><td>PCI bus 1, device 0, function 0</td></tr><tr><td></td><td></td><td>Hardware reserved memory:</td><td>221 MB</td></tr><tr><td></td><td></td><td>GPU Temperature</td><td>48 °C</td></tr></table>	Utilization	Dedicated GPU memory	Driver version	31.0.15.2801	29%	0.4/8.0 GB	Driver date:	12/21/2022	GPU Memory	Shared GPU memory	DirectX version:	12 (12_1)	0.5/15.8 GB	0.1/7.8 GB	Physical location:	PCI bus 1, device 0, function 0			Hardware reserved memory:	221 MB			GPU Temperature	48 °C
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Claims	Identification
	<p>Source: Internal Testing of ASUS Vivobook Pro 16X OLED Laptop.</p>  <p>Source: Internal Testing of ASUS Vivobook Pro 16X OLED Laptop.</p>
10[b] memory;	<p>Asus-branded devices implement a video encoder comprising a memory.</p>  <p>Get the ultimate creative experience with ASUS Vivobook Pro 16X OLED! It features the world's leading 16-inch 3.2K 120 Hz OLED Dolby Vision display<sup>1</sup>, the latest Intel<sup>®</sup> Core<sup>™</sup> HX55 desktop-level processor and up to an NVIDIA<sup>®</sup> GeForce<sup>®</sup> RTX<sup>™</sup> 4070 Laptop GPU — empowering maximum performance for any task, no matter how tough. This powerhouse is chilled by ASUS IceCool Pro thermal technology, with dual fans and four vents to keep it cool and quiet. It's also loaded with superb connectivity, including dual Thunderbolt<sup>™</sup> 4 ports and a standard SD card reader for easy file transfers. With an onboard MUX switch and multi-dimensional Dolby Atmos audio built right in, Vivobook Pro 16X OLED also delivers maximum productivity and entertainment. Get ready to create!</p>

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	<p>Source: <a href="https://www.asus.com/us/laptops/for-creators/vivobook/vivobook-pro-16x-oled-k6604/">https://www.asus.com/us/laptops/for-creators/vivobook/vivobook-pro-16x-oled-k6604/</a></p> <div><div>Graphics</div><div>NVIDIA® GeForce RTX™ 4070 Laptop GPU 8GB GDDR6 Intel® UHD Graphics</div></div> <p>Source: <a href="https://www.asus.com/us/laptops/for-creators/vivobook/vivobook-pro-16x-oled-k6604/techspec/">https://www.asus.com/us/laptops/for-creators/vivobook/vivobook-pro-16x-oled-k6604/techspec/</a></p>  <p>The screenshot shows the Windows Task Manager Performance tab. On the left, a sidebar lists system components: CPU (6% 3.57 GHz), Memory (7.8/15.6 GB (50%)), Disk 0 (C:) (SSD 0%), Wi-Fi (Wi-Fi S: 0 R: 0 Kbps), GPU 0 (Intel(R) UHD Graphics 7%), and GPU 1 (NVIDIA GeForce RTX 40 29%). The main area is titled 'GPU' and shows a graph of GPU usage over time. A red box highlights the 'Video Encode' bar, which is at 29%. Another red box highlights the 'NVIDIA GeForce RTX 4060 Laptop GPU' label. Below the graph, there are two more graphs: 'Dedicated GPU memory usage' (0.4/8.0 GB) and 'Shared GPU memory usage' (0.1/7.8 GB). At the bottom, a table provides detailed GPU information:</p> <table><tr><td>Utilization</td><td>29%</td><td>Dedicated GPU memory</td><td>0.4/8.0 GB</td><td>Driver version:</td><td>31.0.15.2801</td></tr><tr><td>GPU Memory</td><td>0.5/15.8 GB</td><td>Shared GPU memory</td><td>0.1/7.8 GB</td><td>Driver date:</td><td>12/21/2022</td></tr><tr><td></td><td></td><td></td><td></td><td>DirectX version:</td><td>12 (FL 12.1)</td></tr><tr><td></td><td></td><td></td><td></td><td>Physical location:</td><td>PCI bus 1, device 0, function 0</td></tr><tr><td></td><td></td><td></td><td></td><td>Hardware reserved memory:</td><td>221 MB</td></tr><tr><td></td><td></td><td></td><td></td><td>GPU Temperature</td><td>48 °C</td></tr></table>	Utilization	29%	Dedicated GPU memory	0.4/8.0 GB	Driver version:	31.0.15.2801	GPU Memory	0.5/15.8 GB	Shared GPU memory	0.1/7.8 GB	Driver date:	12/21/2022					DirectX version:	12 (FL 12.1)					Physical location:	PCI bus 1, device 0, function 0					Hardware reserved memory:	221 MB					GPU Temperature	48 °C
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Claims	Identification
	 <p>Source: Internal Testing of ASUS Vivobook Pro 16X OLED Laptop.</p>
<p>10[c] a video encoding application executable by the processor and which, when executed, configures the processor to:</p>	<p>Asus-branded devices implement a video encoder that comprises a video encoding application executable by the processor.</p>

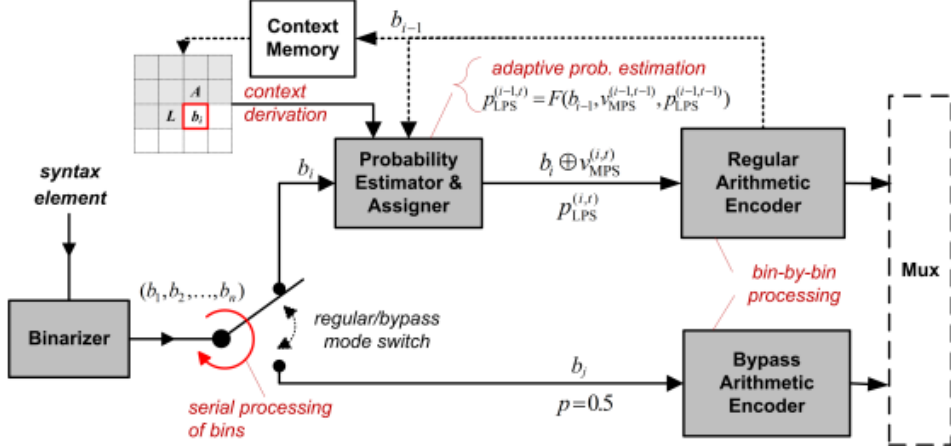
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	<div><p>The screenshot shows the OBS Studio Settings window, specifically the Output tab. The left sidebar contains a menu with options: General, Stream, Output (selected), Audio, Video, Hotkeys, Accessibility, and Advanced. The main area is titled 'Output Mode' and is set to 'Advanced'. Below this, there are tabs for 'Streaming', 'Recording' (selected), 'Audio', and 'Replay Buffer'. Under the 'Recording' tab, the 'Type' is set to 'Standard'. There is an option for 'Automatic File Splitting' which is unchecked, with a dropdown set to 'Split by Time'. The 'Encoder Settings' section includes: 'Rate Control' set to 'VBR', 'Bitrate' set to '2500 Kbps', 'Max Bitrate' set to '5000 Kbps', 'Keyframe Interval (0=auto)' set to '1 s', 'Preset' set to 'P5: Slow (Good Quality)', 'Tuning' set to 'High Quality', 'Multipass Mode' set to 'Two Passes (Quarter Resolution)', 'Profile' set to 'main', an unchecked checkbox for 'Look-ahead', a checked checkbox for 'Psycho Visual Tuning', and 'GPU' set to '0'. At the bottom right of the settings window are buttons for 'OK', 'Cancel', and 'Apply'.</p></div> <p>Source: Internal Testing of ASUS Vivobook Pro 16X OLED Laptop.</p>

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	<div><p>The screenshot shows the Windows Task Manager Performance tab. On the left, a list of system components includes CPU (6% 3.57 GHz), Memory (7.8/15.6 GB (50%)), Disk 0 (C:) (SSD 0%), Wi-Fi (Wi-Fi 5: 0 R, 0 Kbps), GPU 0 (Intel(R) UHD Graphics 7%), and GPU 1 (NVIDIA GeForce RTX 40 29%). The main area displays the GPU performance for the NVIDIA GeForce RTX 4060 Laptop GPU, which is highlighted with a red box. It shows a 29% utilization for Video Decode. Below this, there are graphs for Video Encode (0%) and Video Processing (0%). At the bottom, a summary table provides detailed GPU information.</p><table><tr><td>Utilization</td><td>Dedicated GPU memory</td><td>Driver version</td><td>31.0.15.2801</td></tr><tr><td>29%</td><td>0.4/8.0 GB</td><td>Driver date</td><td>12/21/2022</td></tr><tr><td>GPU Memory</td><td>Shared GPU memory</td><td>DirectX version</td><td>12 (9L 12.1)</td></tr><tr><td>0.5/15.8 GB</td><td>0.1/7.8 GB</td><td>Physical location</td><td>PCI bus 1, device 0, function 0</td></tr><tr><td></td><td></td><td>Hardware reserved memory</td><td>221 MB</td></tr><tr><td></td><td></td><td>GPU Temperature</td><td>48 °C</td></tr></table></div> <p>Source: Internal Testing of ASUS Vivobook Pro 16X OLED Laptop.</p>	Utilization	Dedicated GPU memory	Driver version	31.0.15.2801	29%	0.4/8.0 GB	Driver date	12/21/2022	GPU Memory	Shared GPU memory	DirectX version	12 (9L 12.1)	0.5/15.8 GB	0.1/7.8 GB	Physical location	PCI bus 1, device 0, function 0			Hardware reserved memory	221 MB			GPU Temperature	48 °C
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		GPU Temperature	48 °C																						
10[d] obtain a sequence of quantized coefficients for the block of transform residuals;	<p>Asus-branded devices implement a video encoder that comprises a video encoding application executable by the processor and which, when executed, configures the processor to obtain a sequence of quantized coefficients for the block of transform residuals.</p> <div><p><b>IV. THE RDOQ IN HEVC</b></p><p>The RDOQ has been included in the HEVC reference software (HM) and intensively used during HEVC development and performance. This section describes the RDOQ algorithm adapted to HEVC.</p></div> <p>Source: Rate-distortion optimized quantization in HEVC: Performance Limitations, 3.</p>																								

Claims	Identification
	<p data-bbox="432 159 1041 196"><i>A. Quantization of transform coefficients</i></p> <p data-bbox="432 207 1344 594">In this stage the encoder performs calculation for each of transform coefficients separately. In the first step, <u>the encoder calculates the value <i>Level</i> by quantizing the magnitude of transform coefficient by using the uniform quantizer without dead zone.</u> In the next step, the encoder considers two additional magnitudes of the analyzed quantized coefficient: <i>Level-1</i> and <i>0</i>. For every of the mentioned coefficient magnitudes, the encoder calculates the RD cost of encoding the coefficient with the selected magnitude and chooses the one with the lowest RD cost.</p> <p data-bbox="407 626 1503 659">Source: Rate-distortion optimized quantization in HEVC: Performance Limitations, 3.</p>
<p data-bbox="100 743 373 1463">10[e] calculate, for the obtained sequence, a rate-distortion cost based on a distortion cost and on a rate cost based on a context-adaptive entropy encoder, wherein the context-adaptive entropy encoder encodes each quantized coefficient by selecting at least one context from a plurality of contexts by determining an index for a set of contexts based, at least in part, on a</p>	<p data-bbox="407 743 1990 922">Asus-branded devices implement a video encoder that comprises a video encoding application executable by the processor and which, when executed, configures the processor to calculate, for the obtained sequence, a rate-distortion cost based on a distortion cost and on a rate cost based on a context-adaptive entropy encoder, wherein the context-adaptive entropy encoder encodes each quantized coefficient by selecting at least one context from a plurality of contexts by determining an index for a set of contexts based, at least in part, on a previous quantized coefficient in the sequence of quantized coefficients.</p>

Claims	Identification
previous quantized coefficient in the sequence of quantized coefficients; and	<p data-bbox="506 167 1115 228" style="text-align: center;">V. THE SIMPLIFIED RDOQ IN HEVC REFERENCE SOFTWARE</p> <p data-bbox="426 248 1178 407">In the RDOQ implemented HEVC test model (HM16) [20] the encoder uses only estimated values of introduced distortion (represented by square quantization error) and a number of bits required to encode selected transform coefficient, coefficient group or transform unit.</p> <p data-bbox="426 427 1178 553">For example, for every of the examined coefficient magnitude the encoder calculates the cost <math>RD\_cost(L, c)</math> of encoding the coefficient <math>c</math> with the magnitude <math>L</math> according to (2) and chooses the case with the lowest RD cost.</p> $RD\_cost(L, c) = est\_D(L, c) + \lambda \cdot est\_B(L, c), \quad (2)$ <p data-bbox="426 678 1178 935">where:  <math>c</math> – transform coefficient identifier,  <math>L</math> – value of quantized transform coefficient <math>c</math>,  <math>RD\_cost(L, c)</math> – cost of quantization coefficient <math>c</math> to value <math>L</math>,  <math>est\_D(L, c)</math> – square quantization error,  <math>est\_B(L, c)</math> – estimated number of bits needed do encode coefficient <math>c</math> quantized to value <math>L</math>,  <math>\lambda</math> – Lagrange multiplier.</p> <p data-bbox="426 954 1178 1016">The detailed description of RDOQ implementation in HEVC can be found in [21].</p> <p data-bbox="405 1068 1503 1101">Source: Rate-distortion optimized quantization in HEVC: Performance Limitations, 4.</p>

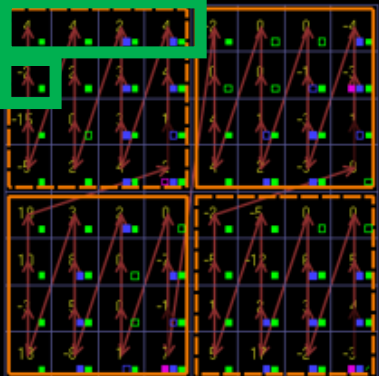
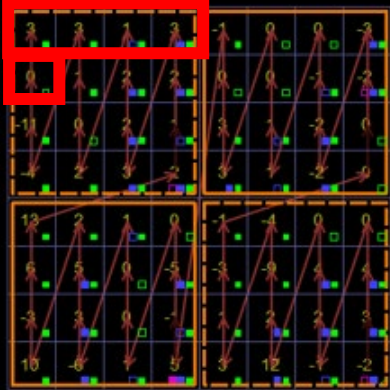
Claims	Identification										
	<div data-bbox="457 175 894 207"> <p><b>4 Abbreviations and acronyms</b></p> </div> <div data-bbox="457 224 1556 248"> <p>For the purposes of this Recommendation   International Standard, the following abbreviations and acronyms apply:</p> </div> <div data-bbox="457 264 1058 467"> <table> <tr> <td>ATSC</td><td>Advanced Television Systems Committee</td></tr> <tr> <td>B</td><td>Bi-predictive</td></tr> <tr> <td>BLA</td><td>Broken Link Access</td></tr> <tr> <td>BPB</td><td>Bitstream Partition Buffer</td></tr> <tr> <td><u>CABAC</u></td><td><u>Context-based Adaptive Binary Arithmetic Coding</u></td></tr> </table> </div> <p>HEVC Specification (H.265), 14.</p> <div data-bbox="447 553 1104 586"> <p><b>9.3 <u>CABAC parsing process for slice segment data</u></b></p> </div> <div data-bbox="447 605 625 634"> <p><b>9.3.1 General</b></p> </div> <div data-bbox="447 651 1560 678"> <p>This process is invoked when parsing syntax elements with descriptor ae(v) in clauses 7.3.8.1 through 7.3.8.12.</p> </div> <div data-bbox="447 695 1545 722"> <p>Inputs to this process are a request for a value of a syntax element and values of prior parsed syntax elements.</p> </div> <div data-bbox="447 740 1014 768"> <p>Output of this process is the value of the syntax element.</p> </div> <div data-bbox="447 786 1650 813"> <p>The initialization process as specified in clause 9.3.2 is invoked when starting the parsing of one or more of the following:</p> </div> <div data-bbox="447 831 1650 979"> <ol style="list-style-type: none"> <li>1. the slice segment data syntax specified in clause 7.3.8.1,</li> <li>2. the CTU syntax specified in clause 7.3.8.2 and the CTU is the first CTU in a tile,</li> <li>3. the CTU syntax specified in clause 7.3.8.2, entropy_coding_sync_enabled_flag is equal to 1 and the associated luma CTB is the first luma CTB in a CTU row of a tile.</li> </ol> </div> <div data-bbox="447 997 972 1024"> <p>The parsing of syntax elements proceeds as follows:</p> </div> <div data-bbox="447 1042 1650 1128"> <p>When cabac_bypass_alignment_enabled_flag is equal to 1, the request for a value of a syntax element is for either the syntax elements coeff_abs_level_remaining[ ] or coeff_sign_flag[ ] and escapeDataPresent is equal to 1, the alignment process prior to aligned bypass decoding as specified in clause 9.3.4.3.6 is invoked.</p> </div> <p>Source: HEVC Specification (H.265), 203.</p>	ATSC	Advanced Television Systems Committee	B	Bi-predictive	BLA	Broken Link Access	BPB	Bitstream Partition Buffer	<u>CABAC</u>	<u>Context-based Adaptive Binary Arithmetic Coding</u>
ATSC	Advanced Television Systems Committee										
B	Bi-predictive										
BLA	Broken Link Access										
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<u>CABAC</u>	<u>Context-based Adaptive Binary Arithmetic Coding</u>										

Claims	Identification
	<p>The basic design of CABAC involves the key elements of binarization, context modeling, and binary arithmetic coding. These elements are illustrated as the main algorithmic building blocks of the CABAC encoding block diagram in Fig. 1. Binarization maps the syntax elements to binary symbols (bins). Context modeling estimates the probability of each non-bypassed (i.e., regular coded) bin based on some specific context. Finally, binary arithmetic coding compresses the bins to bits according to the estimated probability.</p>  <p>Fig. 1: CABAC block diagram (from the encoder perspective): Binarization, context modeling (including probability estimation and assignment), and binary arithmetic coding. In red: Potential throughput bottlenecks, as further discussed from the decoder perspective in Sect. 3.2.</p> <p>Source: Entropy Coding in HEVC, 4.</p>

Claims	Identification
	<p data-bbox="426 142 1308 178"><b><i>2.2 Context Modeling, Probability Estimation and Assignment</i></b></p> <p data-bbox="426 228 1377 802">By decomposing each non-binary syntax element value into a sequence of bins, further processing of each bin value in CABAC depends on the associated coding-mode decision, which can be either chosen as the regular or the bypass mode (as described in Sect. 2.3). The latter is chosen for bins, which are assumed to be uniformly distributed and for which, consequently, the whole regular binary arithmetic encoding (and decoding) process is simply bypassed. In the regular coding mode, each bin value is encoded by using the regular binary arithmetic coding engine, where the associated probability model is either determined by a fixed choice, based on the type of syntax element and the bin position or <u>bin index (binIdx)</u> in the binarized representation of the syntax element, or adaptively <u>chosen from two or more</u> probability models depending on the related side information (e.g. spatial neighbors as illustrated in Fig. 1, component, depth or size of CU/PU/TU, or position within TU). Selection of the probability model is referred to as context modeling. As an important design decision, the latter case is generally applied to the most frequently observed bins only, whereas the other, usually less frequently observed bins, will be treated using a joint, typically zero-order probability model. In this way, CABAC enables selective adaptive probability modeling on a sub-symbol level, and hence,</p> <p data-bbox="405 834 882 867">Source: Entropy Coding in HEVC, 6.</p>
10[f] change a value of one of said quantized coefficients of the obtained sequence to produce a new sequence of quantized coefficients, so that a resulting rate-distortion cost for the new sequence of quantized coefficients is smaller than a rate-distortion cost for the obtained sequence.	Asus-branded devices implement a video encoder that comprises a video encoding application executable by the processor and which, when executed, configures the processor to change a value of one of said quantized coefficients of the obtained sequence to produce a new sequence of quantized coefficients, so that a resulting rate-distortion cost for the new sequence of quantized coefficients is smaller than a rate-distortion cost for the obtained sequence.



Claims	Identification
	<p style="text-align: center;">IV. THE RDOQ IN HEVC</p> <p>The RDOQ has been included in the HEVC reference software (HM) and intensively used during HEVC development and performance. This section describes the RDOQ algorithm adapted to HEVC.</p> <p>...</p> <p><i>A. Quantization of transform coefficients</i></p> <p>In this stage the encoder performs calculation for each of transform coefficients separately. In the first step, the encoder calculates the value <i>Level</i> by quantizing the magnitude of transform coefficient by using the uniform quantizer without dead zone. In the next step, the encoder considers two additional magnitudes of the analyzed quantized coefficient: <u><i>Level-1</i> and <i>0</i></u>. For every of the mentioned coefficient magnitudes, the encoder calculates the RD cost of encoding the coefficient with the selected magnitude and chooses the one with the lowest RD cost.</p> <p>Source: Rate-distortion optimized quantization in HEVC: Performance Limitations, 3.</p> <p>Asus-branded devices perform rate-distortion optimization. For example, the following depicts video frames with Psycho Visual tuning disabled (on the left) and Psycho Visual tuning enabled to enable rate-distortion optimization (on the right).</p>

Claims	Identification
	<div><div><div><div>3-5-24 Static Recording Without Psycho Visual Tuning.mkv   VQ Analyzer 2024 7.4.0.80497   13964</div><div>File Mode YUVDiff Options View Help</div><div>Stream View   HEVC v1   C:/Users/[redacted]/Desktop/3-5-24 Static Recording Without Psycho Visual Tuning.mkv</div><div>Thumbnails ▾ Picture: 0 Display ActiveRefs</div><div><div>0/0-IDR_W_RADL... POC = 0</div><div>1/3-TRAIL_R... POC = 3</div><div>2/1-TRAIL_N... POC = 1</div><div>3/2-TRAIL_N... POC = 2</div><div>4/6-TRAIL_N... POC = 4</div></div><div>Transform block (416,48) details</div><div>Y Levels (416,48)</div><div></div></div></div><div>Quantized coefficients for HEVC encoded video with Psycho Visual tuning disabled</div><div><div>3-5-24 Static Recording With Psycho Visual Tuning.mkv   VQ Analyzer 2024 7.4.0.80497   19700</div><div>File Mode YUVDiff Options View Help</div><div>Stream View   HEVC v1   C:/Users/[redacted]/Desktop/3-5-24 Static Recording With Psycho Visual Tuning.mkv</div><div>Thumbnails ▾ Picture: 0 Display ActiveRefs</div><div><div>0/0-IDR_W_RADL... POC = 0</div><div>1/3-TRAIL_R... POC = 3</div><div>2/1-TRAIL_N... POC = 1</div><div>3/2-TRAIL_N... POC = 2</div><div>4/6-TRAIL_N... POC = 4</div></div><div>Transform block (416,48) details</div><div>Y Levels (416,48)</div><div></div></div></div> <div>Quantized coefficients for HEVC encoded video with Psycho Visual tuning enabled (to enable rate-distortion optimization)</div>
	<p>Source: Internal Testing of ASUS Vivobook Pro 16X OLED Laptop.</p> <p>After enabling the psycho-visual setting (to enable rate-distortion optimization), the magnitude of the quantized coefficient for some of the coefficients is decreased by 1 and/or reduced to 0. <i>Compare</i> the quantized coefficients in the green box with the quantized coefficients in the red box.</p> <p>The change in magnitude of the quantized coefficients when Psycho Visual Tuning is enabled indicates rate-distortion optimization.</p>